



# Managing farm water supplies in drought

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## Introduction

Drought invariably puts stress on farm water supplies. Properties that have access to reliable groundwater are fortunate, whereas those using dams reliant on runoff will require more complex management of their water supplies.

The challenge in drought times is to provide water that is 'fit for purpose'. Water requirements for livestock will vary considerably, therefore the water you provide should be suitable for your particular class of stock.

This booklet is designed to provide you with helpful information covering a range of water requirement and quality issues along with a range of helpful tips on water management.



# Contents

Introduction	3
Stock water quality	5
Water salinity	6
Water testing	7
Salinity tolerance levels for stock	8
Stock daily water requirements	10
How long will my dam last?	11
Salinity tolerance levels for plants	12
Water quality levels acceptable for human consumption	13
Blue green algae	14
Helpful tips	15
Conversions	17
Contacts	18
References	19

## Stock water quality

Element	Rainwater	Upper limit	Effect
Calcium	40 mg/L	>1000 mg/L	phosphorous deficiency
Magnesium	0-19 mg/L	> 1000 mg/L	scouring and diarrhoea
Nitrate	10 mg/L 1 mg/L	>1500 mg/L nitrate, >30 mg/L nitrite	Vomiting, convulsions, death
Sulfate	250 mg/L	>1000-2000 mg/L	diarrhoea
Aluminium	0.05-0.2 mg/L	5 mg/L	phosphorous deficiency
Arsenic		0.5 mg/L	Diarrhoea, anaemia, poor coordination
Copper	1 mg/L	0.5 mg/L	Liver damage and jaundice, Cu accumulation in the liver
Fluoride	1 mg/L	>2 mg/L	Tooth damage and bone lesions
Iron	0.3 mg/L	Low toxicity	
Lead	0.015 mg/L	0.1 mg/L	Respiratory diseases, anorexia, unco ordination.
Molybdenum (related to copper)		0.15 mg/L	Scouring and loss of condition. Infertility, skeletal disorders, testicular damage.
pH	6.5-8.5	>9 <5	Other mineral become available such as copper and Aluminium
Total Dissolved Solids	500 mg/L	Variable generally > 5000 mg/L	Poor production, diarrhoea, higher mortality rates

The upper limits of mineral and metal levels described above will vary due to specific geology weathering, acid conditions, in conjunction with high salinity levels or specific management. If feed contains the particular minerals limits are lower. Guidelines from the ANZECC (2000).



## Water salinity

- Salinity is the major water quality issue for western Victoria in times of drought. Salts accumulate in the landscape by groundwater movement through weathered rocks and through salts present in rainfall.
- Salts can make their way into waterways and dams and will concentrate through evaporation.
- Salinity refers to all the mineral salts present in the water, including sodium, calcium, magnesium, chloride, sulfate and carbonate.
- High levels make water unsuitable for drinking and/or irrigation.
- Electrical conductivity (EC) of water can be used as a measure of salinity. The higher the value the higher the salt content. Units are micro siemens/centimeter ( $\mu\text{s}/\text{cm}$ )
- Seawater = 55000  $\mu\text{s}/\text{cm}$   
Rainwater = (100-300)  $\mu\text{s}/\text{cm}$



## Water testing

### Why should I have my water tested?

- Water quality affects plant growth, livestock health, soil quality, farm equipment and infrastructure, and domestic use.
- Water quality is variable depending upon weather conditions. Evaporation increases concentrations of salts, a flush of water dilutes salts but may increase sediment and stock waste runoff.
- Monitoring should be done regularly in drought conditions – monthly



### Testing

- Rinse meters and container in water to be tested. Read off numbers taking note of units.
- Stock bores can be tested on **freshly pumped** water at the trough.
- Bores should be monitored at regular intervals (monthly or quarterly), for example March, June, September and December.
- EC meters are relatively inexpensive and available at various water equipment dealers.
- EC and pH measurements are done free of charge at many Department of Primary Industries (DPI) locations.
- For more in depth water tests including mineral analysis contact the DPI for more information.



## Salinity tolerance levels for stock water

Type of Livestock		EC ( $\mu\text{S}/\text{cm}$ )	mg/L* (ppm)
<b>Poultry</b>	production decline begins	3,100	2,000
	maximum	6,250	4,000
<b>Pigs</b>	production decline begins	3,100	2,000
	maximum	6,250	4,000
<b>Horses</b>	health / growth affected	6,250	4,000
	maximum	10,900	7,000
<b>Dairy Cattle</b>	Production decline begins	4,700	3,000
	maximum	9,300	6,000
<b>Beef Cattle</b>	Production decline begins	6,250	4,000
	maximum	15,600	10,000
<b>Lactating Ewes, Weaners</b>	Production decline begins	6,000	3,800
	maximum	10,000	6,400
<b>Sheep, dry feed</b>	Production decline begins	9,300	6,000
	maximum	21,800	14,000



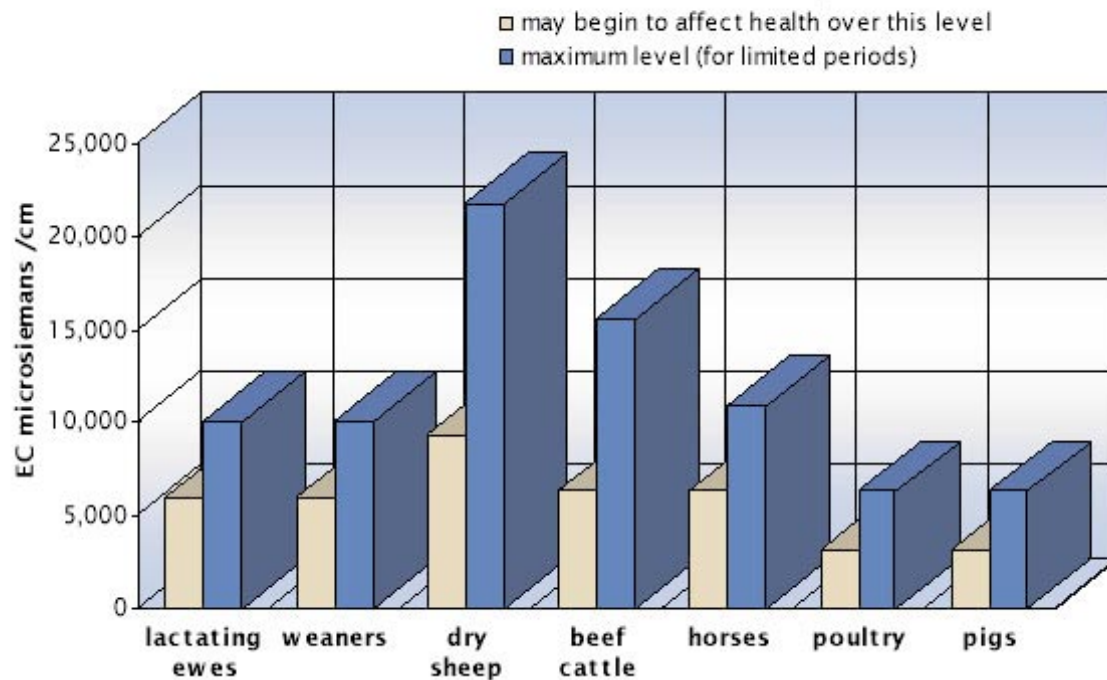
**Production decline begins:** desirable maximum salt concentration for healthy growth.

**Maximum:** maximum salt concentration that may be safe for limited periods.

\*DNRE (1998)



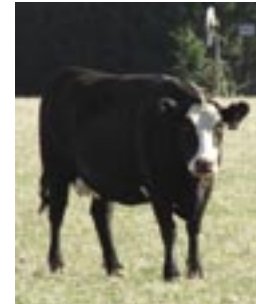
## EC for Livestock Water Quality



## Livestock daily water requirements

Daily water intake varies widely among different forms of livestock and is also influenced by factors such as climate and the type of feed being consumed. Note peak consumption for the your local area could be significantly higher i.e. dairy cattle in SW VIC – 200L/day

Type of livestock	Average daily consumption (litres/head)	Peak daily consumption (litres/head)
<b>Sheep</b>		
Nursing ewes on dry feed	9	11.5
Mature sheep on dry pastures	7	8.5
Mature sheep on green pastures	3.5	4.5
Fattening lambs on dry pasture	2.2	3
Fattening lambs on green pasture	1.1	
<b>Cattle</b>		
Dairy cows in milk	70	85
Dairy cows, dry	45	60
Beef cattle	45	60
Calves	22	30
<b>Horses</b>		
Working	55	70
Grazing	35	45
<b>Pigs</b>		
Brood sows	22	30
Mature pigs	11	15
<b>Poultry</b>	<b>(litres/100 birds)</b>	<b>(litres/100 birds)</b>
Laying hens	32	40
Non-laying hens	18	23
Turkeys	55	70



\*Australian and New Zealand Guidelines (Section 9.3.1 Livestock drinking water guidelines) (Table)

## How long will my dam last?

- Calculate the number of stock using the water supply and apply average daily consumption figures. (consumption can escalate dramatically with sustained hot weather or stock on supplementary feed).
- Calculate dam volume. (remember to allow for ~ 10% seepage and evaporation losses during summer).
- Calculate dam volume and consumption estimates in the same units, e.g. litres, divide the dam volume by the daily consumption to estimate the days of water left.

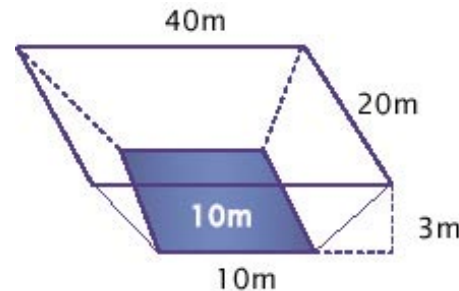
### Volume in m<sup>3</sup> for a rectangular or square dam

- **Length at bottom x width at bottom** = a
- **Length at top x width at top** = b
- **(Sum of lengths) x (sum of widths)** = c
- **(a + b + c) x depth/6** = volume m<sup>3</sup>

#### EXAMPLE

- $10m \times 10m = 100$
- $40m \times 20m = 800$
- $50m \times 30m = 1500$
- $[(100+800+1500) \times 3] / 6 = 1200$  cubic meters
- *minus 10% for evaporation*
- $= 1200 - (0.1 \times 1200)$
- $= 1080m^3$
- $= 1,080,000$  L

200 head beef cattle @ 45 L water /day.  
= 9,000 L water consumed each day  
=  $1,080,000 / 9,000$   
= 120 days of water



## Salt tolerance levels for plants

EC ( $\mu\text{S}/\text{m}$ )	Water salinity rating	Plant suitability
650	Very low	Sensitive crops i.e. red and white clover
650-1300	Low	Moderately sensitive i.e. oats, wheat, lucerne, rye
1300-2900	Medium	Moderately tolerant crops
2900-5200	High	Tolerant crops
5200-8100	Very high	Very tolerant crops: Paspalum, Phalaris, perennial ryegrass, tall fescue, couch grass
>8100	Extreme	Highly tolerant: saltwater couch, puccinellia, saltbush

1dS/m = 1000  $\mu\text{S}/\text{cm}$

Note: values are water EC not soil EC

\*Australian and New Zealand Guidelines (Section 9.2 – Water quality for irrigation and general use). (Table)



## Water quality levels acceptable for human consumption

Characteristic	Unit	Guideline value
Turbidity	NTU	5 at tap: preferably <1 for disinfection
Colour	Pt-Co	15
Salinity	$\mu\text{S}/\text{cm}$	1000
Hardness (CaCo.)	mg/L	500
pH	pH	6.5 – 8.5
Chloride	mg/L	400
Nitrate (as N)*	mg/L	10*



\* Note that the guideline value is given in terms of nitrogen, not nitrate, but is equivalent to 50 mg/L of nitrate.

Australian and New Zealand Guidelines(2000) (Section 9.2 – Water quality for irrigation and general use).



## Blue green algae

Blue-green algae is naturally occurring but in certain conditions populations can explode causing water quality issues. Thick scum occurs on the water surface and shorelines which can reduce oxygen levels for aquatic plant and animals. Some species of blue-green algae produce toxins during decomposition which lead to respiratory and neuro-muscular disorders in livestock.

### What to look for:-

- Inky looking, green, blue-green or khaki green stain in the water, turning brown/green or white once it is dying off.
- Scum may appear at dusk or dawn and disappear during the day.
- A strong earth smell, or if the bloom is breaking down it may produce a strong rotting smell.

### What to do:

- Get your water tested to determine if it is toxic – see contacts page for details
- Remove stock from paddock or have an alternate water source and restrict access to affected area.
- There are some commercial options available for short term control of blue green algae. Contact DPI for further information



## Helpful tips

- Water loss through evaporation is substantial. If you have a number of shallow dams, think about pumping water to a single dam to minimise evaporative losses.
- Water harvested from farm sheds in excess of domestic requirements can contribute to overall stock supplies by troughing to nearby paddocks from tanks.
- When piping around the farm remember doubling the pipe diameter will increase the flow rate four times. 50mm pipe will deliver four times the supply compared to 25 mm pipe.
- Large water troughs located centrally in paddocks reduce the walking distances stock, minimising the creation of stock tracks that can erode.
- The relatively new technology of “air well pumps” increase the options of supplying water around the farm from a reliable source, either dam or bore by means of compressed air, without any requirement for wind. These pumps also have the capacity to pump water to considerable heights.
- If sheep are held in containment areas over summer, cheap water troughs can be constructed from PVC pipes.
- Water carting is often a last resort option. Currently, many water carting contractors utilise milk tankers and can deliver up to 30,000 litres per load. This can enhance time and cost efficiency.
- Water troughs with low usage, need to be flushed out periodically as evaporation will lead to a concentration of any salts present.



- It is essential that carted water be delivered to tanks and reticulated to troughs. Filling dams is inefficient and wasteful.
- Gully dams with bare paddock catchment areas need to be protected from manure 'runoff' into dams after heavy rainfall. This can be done by constructing silt traps with small hay bales or various types of mesh upstream of the dam.
- If dams do become polluted with manure, and stock will not drink from them, you should anticipate providing an alternative supply.





## Conversions

- $\mu\text{S}/\text{cm} \div 1.56 = \text{ppm}$
- $\mu\text{S}/\text{cm} \times 0.001 = \text{mS}/\text{cm}$
- $\text{mS}/\text{m} = \text{dS}/\text{cm}$
- $1 \text{ mg}/\text{L} = 1 \text{ ppm} = 1 \text{ g}/\text{m}^3$
- $1 \text{ ML} = 1\,000\,000 \text{ L} = 1\,000 \text{ m}^3$

*Note:*  $L = \text{litre},$   
 $ML = \text{megalitre},$   
 $mg = \text{milligram},$   
 $\text{m}^3 = \text{cubic metre},$   
 $mm = \text{millimetre},$   
 $ha = \text{hectare},$   
 $\mu\text{S}/\text{cm} = \text{microSieman/centimetre}$   
 $\text{mS}/\text{cm} = \text{milliSieman per centimeter}$   
 $\text{dS}/\text{m} = \text{deciSiemens per metre}$

Seawater = 55 000  $\mu\text{S}/\text{cm}$   
= 55  $\text{mS}/\text{cm}$   
= 55  $\text{dS}/\text{m}$

\* ppm stands for parts per million



## Contacts

### **Department of Primary Industries**

Customer Service Line Telephone: 136 186

Or your local office.

Website: [www.dpi.vic.gov.au](http://www.dpi.vic.gov.au)

*Water testing, further advice on any information provided here.*

### **Department of Sustainability and Environment**

Customer Service Line Telephone: 136 186

Or your local office

Website: [www.dse.vic.gov.au](http://www.dse.vic.gov.au)

*General water information, monthly water reports, drought information*

### **Victorian Water Resources Data Warehouse**

Website:

[www.vicwaterdata.net/vicwaterdata/home.aspx](http://www.vicwaterdata.net/vicwaterdata/home.aspx)

*Up-to-date information on Victoria's water resources with data on both water quality and quantity for all catchments. Includes data on past and present stream and groundwater monitoring and conditions*

### **SKM Groundwater Enquiry Service**

PH:- (03) 9508 6120

*Provide: \*Groundwater information on: Water quality, Depth to water, Suitability and Flow.*

### **Bore Construction Licence or Groundwater Licence**

#### **Southern Rural Water**

Telephone: 1300 139 510 or Warrnambool Office: (03) 5564 1700

Website:- [www.srw.com.au](http://www.srw.com.au)

### **Grampians Wimmera Mallee Water**

Telephone: 1300 659 961

Website: [www.gwmwater.org.au](http://www.gwmwater.org.au)

### **NATA Facilities and Labs**

Deakin University, Warrnambool

Contact: Ms K V Hill Telephone: (03) 5563 3481

NATA Website: [www.nata.asn.au](http://www.nata.asn.au)

*Water testing service – Blue green algae and chemistry*

### **Water Ecoscience**

Website: [www.wes.com.au/start.htm](http://www.wes.com.au/start.htm)

Tel: 03 9731 1077 Fax: 03 9731 1099

Email: [qualitycounts@wes.com.au](mailto:qualitycounts@wes.com.au)

*Water testing service – Blue green algae and chemistry.*

### **Victorian Farmers Federation**

Victorian drought support

Website: [www.drought.org.au](http://www.drought.org.au)

## References

ANZECC 2000. *Australian water quality guidelines for fresh and marine waters*. National Water Quality Management Strategy Paper No 4, The Guidelines (Chapters 1-7) October 2000  
Australian and New Zealand Environment and Conservation Council, Canberra.  
<http://www.environment.gov.au/water/quality/nwqms/pubs/wqg-contents.pdf>

Southern Rural Water  
[www.srw.com.au](http://www.srw.com.au)

Department of Primary Industries Agriculture Notes  
[www.dpi.vic.gov.au/notes/](http://www.dpi.vic.gov.au/notes/)



